

SERIAL COMPOSITION OF HUMAN MILK IN PRETERM AND TERM MOTHERS

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ABSTRACT

Human milk samples were collected from 86 mothers included in the study on days 3, 7, 14 and 28 of lactation. The mothers were divided into three groups on the basis of gestation viz. group I : 37-41 weeks (n=41), group II : 33-36 (n=23) and group III : <33 weeks gestation (n=22). All the samples were analysed for the estimation of fat, lactose and protein. The results obtained from the investigations were statistically analysed. The analysis of the results revealed a lower amount of fat and lactose in preterm milk as compared to term milk ($p < 0.01$). These were found to increase in amount with increasing postnatal age ($p < 0.05$). The protein levels were observed to be significantly higher in preterm than term milk ($p < 0.01$). These were observed to decrease significantly with increase in postnatal age ($p < 0.01$).

KEY WORDS

Fat, Human milk, Lactose, Protein.

INTRODUCTION

Since the dawn of civilisation, human milk has been regarded as the best and complete nourishment for a neonate. Nature has not produced any food as nutritious and unique as human milk. Human milk is not a uniform body fluid but a secretion of the mammary gland of changing composition. Foremilk differs from hind milk while colostrum from transitional and mature milk. The composition of milk changes as time goes by. Many authors have demonstrated that the composition of human milk from a mother who delivers prematurely differs from that of a mother who delivers at term. The milk produced during the first month following parturition by mothers delivering between 28-36 weeks gestation contained significantly higher concentration of nitrogen and lower concentration of lactose than milk produced by mothers delivering at term (1). A significant higher nitrogen content in premature infants have been demonstrated in the first three weeks of lactation (2). Preterm human milk has

been regarded as a suitable food for premature infants (3). However, Paul *et al.* (4) could not find any significant difference in energy, protein, fat and lactose contents between preterm and term milk.

The committee on Nutrition of the American Academy of Pediatrics (5) recommends that post natal growth of premature infants should approximate the *in utero* growth of normal fetus of the same gestational age because these standards offer the best possible model for subsequent growth and development. The committee recommends an energy intake of approximately 120 Cal/kg/day to enable most premature infants to achieve satisfactory growth rates. Higher concentration of calories, proteins and lower concentration of lactose have been demonstrated in preterm milk as compared to mature milk for at least four weeks of lactation. Fat absorption was found to be poorest in the group fed pooled breast milk. Nutritional status as measured by plasma total protein, albumin concentration and weight gain tended to be very poor in the group fed pooled breast milk (6). Fresh milk provided by the infants own mother appeared to have several advantages over pooled breast milk and formula feed. A study from Turkey suggested a pulsatile pattern of weight gain in preterm infants (7). A higher concentration of protein, fat and lower concentration of lactose has been reported in preterm milk as compared to term milk (8). The amount and composition of human milk fat is ideal

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to cover the needs of newborn infants (9). Triglycerides constitute more than 95% of the dietary fat and provide about half the energy in the diet of a milk fed infants.

The studies conducted both in India and abroad have recommended the use of mother's milk for adequate growth and development of a preterm neonate. There have been conflicting reports in the composition of preterm and term milk (4, 10). The present study was conducted to evaluate the differences in concentration of protein, lactose and fat content in preterm and term human milk in mothers over the first 28 days of lactation.

MATERIAL AND METHODS

The comparative study of serial composition of human milk was conducted on mothers delivering in Dayanand Medical College and Hospital, Ludhiana, Punjab. They were selected in random manner after explaining the nature and purpose of the study and taking their informed consent. One hundred mothers were enrolled in the study and divided into three groups on the basis of gestation viz. Group I : 37-41 weeks, group II : 33-36 weeks and group III : <33 weeks. Fourteen cases has to excluded from the study for various reasons like loss of followup, sick general condition of the neonate or chronic illness of the mother. Eightysix mothers who were in the age group of 21 to 35 years, comprised the study group. The mean maternal age in group I, II and III was 25.5 ± 5.00 , 25.17 ± 4.92 and 25.36 ± 5.14 , respectively. All of them were found to have normal blood Hb, glucose, renal and liver function tests. They started with breast feeds or expressed breast feeds within 48 hours of birth. 5 ml of breast milk was collected on days 3, 7, 14 and 28 by manual expression. The breast was cleaned with water and then emptied by the rhythmical rolling motikon of thumb and index finger while holding it 2 to 3 cms behind the nipple. The milk was collected in clean glass vials.

The fat, lactose and protein were estimated by Milkoscan-130 (U.S.A.). Within the infra red spectrum fat, lactose and protein have characteristic absorption wavelengths. When the intensity of the light transmitted at precisely these wavelengths is measured, a measure of the concentration of the component is obtained. Milkoscan-130 is based on a single beam principle, the filters are arranged in a filter wheel which rotates to bring each of the filters in turn per component into position in the path of infra red beam. The microprocessor probe of the milkoscan was first cleaned with distilled water to remove the chance of error due to contamination. Three ml of milk sample was introduced to the probe. The sample was analysed

and the concentration of protein, lactose and fat was determined on the milkoscan. All the 344 samples were analysed for their protein, lactose and fat contents.

The data obtained was tabulated. Mean and standard deviation was computed for different variables. To compare mean levels of fat, protein and lactose, Fisher's Z test was applied. Unpaired t-test was applied for comparing the two means with $n_1 + n_{2-2}$ degrees of freedom. The significance of values was seen at appropriate degrees of freedom at 5%, 1% or 0.1% level of significance.

RESULTS

Eighty six mothers formed the study group. These were distributed into three groups on the basis of gestation viz. group I (37-41 weeks) - 41 cases, group II (33-36 weeks) - 23 cases and group III (<33 weeks) - 22 cases.

The mean protein content in human milk on days 3, 7, 14 and 28 are presented in Table 1 (a, b, c). It was found to increase significantly with increasing postnatal age in all the three groups. The protein content of preterm milk was observed to be significantly higher than that of term milk. The difference between preterm and term milk in protein content remained significant with increasing postnatal age.

The lactose content in milk are represented in Table 2 (a, b, c). There was a significant increase in the lactose content in all the three groups with increasing postnatal age. Intergroup variability was observed. The preterm groups were found to contain a significantly lower lactose content than term group. This difference remained throughout the period of study.

The fat content of human milk are presented in Table 3 (a, b, c). It was observed to increase with increasing postnatal age in all three groups. The difference with increasing postnatal age was significant. Intergroup variability was observed in preterm groups. The fat content was found to be lower in preterm group (Group II and III).

DISCUSSION

The use of human milk for feeding of preterm neonates has been dogged with controversies since long. In the present study, the protein content was found to be significantly higher in preterm milk than term milk. The content was however found to decrease with increasing postnatal age. Similar findings have been reported earlier (11-15). Although in one report by Paul *et al.*, no significant difference could be found in preterm and term milk (4).

Table 1 (a). Means \pm S.D. protein content (g/dl) in term and preterm milk

Group	Number of subjects	Postnatal age in days			
		3	7	14	28
I	41	1.9 \pm 0.69	1.6 \pm 0.63	1.3 \pm 0.57	1.1 \pm 0.48
II	23	4.0 \pm 0.35	2.9 \pm 0.51	1.9 \pm 0.54	0.9 \pm 0.45
III	22	4.1 \pm 0.52	3.4 \pm 0.48	2.4 \pm 0.56	1.6 \pm 0.53

Table 1 (b). Protein content (g/dl) with respect to postnatal age (Z values)

Group	Postnatal age in days					
	3 vs 7	3 vs 14	3 vs 28	7 vs 14	7 vs 28	14 vs 28
I	1.95 ^{NS}	4.29*	6.09**	2.26*	4.04*	1.741 ^{NS}
II	8.53**	16.77**	25.82**	6.45**	14.10**	6.82**
III	4.64**	10.43**	15.79**	6.36**	11.80**	4.86**

Table 1 (c). Intergroup variation in protein content (Z values)

Group	Postnatal age in days			
	3	7	14	28
I vs II	16.13**	8.97**	4.18*	1.66 ^{NS}
I vs III	14.22**	12.68**	6.71**	3.69*
II vs III	0.75 ^{NS}	3.39*	3.04*	4.76**

** Significant $p < 0.01$

* Significant $p < 0.05$

NS Non Significant

Table 2 (a). Lactose content (g/dl) Means \pm S.D. in term and preterm milk

Group	Number of subjects	Postnatal age in days			
		3	7	14	28
I	41	5.18 \pm 0.44	4.60 \pm 0.90	5.00 \pm 1.10	7.70 \pm 1.30
II	23	4.74 \pm 0.54	5.70 \pm 0.50	6.70 \pm 0.43	7.50 \pm 0.29
III	22	3.80 \pm 0.87	5.40 \pm 0.33	6.10 \pm 1.60	7.00 \pm 0.34

Table 2 (b). Lactose content (g/dl) with respect to postnatal age (Z values)

Group	Postnatal age in days					
	3 vs 7	3 vs 14	3 vs 28	7 vs 14	7 vs 28	14 vs 28
I	14.51**	0.97 ^{NS}	13.30**	13.34**	5.28**	10.15**
II	6.24**	13.60**	21.56**	7.27**	14.29**	7.39**
III	8.06**	5.90**	16.06**	1.90 ^{NS}	15.82**	2.57*

Table 2 (c). Intergroup variation in lactose content (Z values)

Group	Postnatal age in days			
	3	7	14	28
I vs II	3.33*	12.40**	8.77**	1.94 ^{NS}
I vs III	6.97**	13.77**	2.87*	3.24*
II vs III	4.32**	2.38*	1.70 ^{NS}	2.29*

** Significant $p < 0.01$

* Significant $p < 0.05$

NS Non Significant

Table 3 (a). Means \pm S.D. fat content (g/dl) in term and preterm milk

Group	Number of subjects	Postnatal age in days			
		3	7	14	28
I	41	2.0 \pm 0.58	2.5 \pm 0.73	2.8 \pm 0.74	3.1 \pm 0.69
II	23	1.3 \pm 0.26	2.1 \pm 0.30	3.0 \pm 0.34	3.6 \pm 0.27
III	22	1.2 \pm 0.21	1.9 \pm 0.19	2.4 \pm 0.27	3.1 \pm 0.29

Table 3 (b). Fat content (g/dl) with respect to postnatal age (Z values)

Group	Postnatal age in days					
	3 vs 7	3 vs 14	3 vs 28	7 vs 14	7 vs 28	14 vs 28
I	3.43*	5.44**	7.81**	1.85 ^{NS}	3.82*	1.89 ^{NS}
II	7.91**	19.04**	29.42**	9.51**	17.82**	6.62**
III	11.59**	16.45**	24.88**	7.10**	16.23**	8.28**

Table 3 (c). Intergroup variation in fat content (Z values)

Group	Postnatal age in days			
	3	7	14	28
I vs II	6.63**	3.07*	1.47 ^{NS}	4.11**
I vs III	7.91**	4.96**	3.09*	0.00 ^{NS}
II vs III	1.42 ^{NS}	1.86 ^{NS}	6.57**	3.80*

** Significant $p < 0.01$

* Significant $p < 0.05$

NS Non Significant

The preterm milk was found to contain a significantly lower lactose content than the term milk throughout the period of the study. In the Indian context Kumbhat *et al.* (16) could not find a significant difference in lactose of preterm and term milk. The lactose content was found to increase with increasing post natal age in both term and preterm milk.

The fat content was found to increase with progressing lactation. It was observed to be in a significantly lower concentration in the milk of mothers delivering prematurely as compared to term mothers. Kumbhat *et al.* (16) has reported the difference in fat concentration in preterm and term milk as non-significant. Paul *et al.* (17) has reported a significant increase in fat concentration with progressing lactation but no significant difference between term and preterm milk. Gross *et al.* (11) has observed a non-significant difference in fat concentration either with progress of lactation or decreased gestation.

The present study depicts a lower lactose and fat content and a higher protein content in preterm than term milk. For premature infants, neonatal centres should encourage the feeding of fortified human milk.

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